IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Takayasu YAMAZAKI et al.

Application No.: 10/585,759 Confirmation No.: 7895

Filed: July 12, 2006 Art Unit: 3656

For: RACK-AND-PINION STEERING APPARATUS Examiner: M. Johnson

APPEAL BRIEF TRANSMITTAL FORM

MS Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Transmitted herewith is an Appeal Brief on behalf of the Appellants in connection with the above-identified application.

☐ The enclosed document is being transmitted via the Certificate of Mailing provisions of 37 C.F.R. § 1.8.

A Notice of Appeal was filed on April 8, 2010.

☐ Applicant claims small entity status in accordance with 37 C.F.R. § 1.27.

The fee has been calculated as shown below:

☒ Extension of time fee pursuant to 37 C.F.R. §§ 1.17 and 1.136(a) - $490.00.

☒ Fee for filing an Appeal Brief - $540.00 (large entity).

☐ Check(s) in the amount of $@@@ is(are) attached.

☒ Please charge Deposit Account No. 02-2448 as indicated on the attached Fee Transmittal.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Dated: August 23, 2010

Respectfully submitted,

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Attachments

Docket No.: 1560-0462PUS1
(Patent)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application of:	Takayasu YAMAZAKI et al.	**Before the Board of Appeals**	
Application No.:	10/585,759	Confirmation No.:	7895
Filed:	July 12, 2006	Art Unit:	3656
For:	RACK-AND-PINION STEERING APPARATUS	Examiner:	M. Johnson

APPEAL BRIEF

MS APPEAL BRIEF-PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Appeal Brief is in furtherance of the Notice of Appeal filed in this case on April 8, 2010. This Appeal Brief is being filed with a two month extension because a Notice of Panel Decision from Pre-Appeal Brief was not mailed until May 25, 2010.

The fees required under § 41.20(b)(2) are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

This brief contains items under the following headings as required by 37 C.F.R. § 41.37 and M.P.E.P. § 1206:

I. REAL PARTY IN INTEREST

The real party in interest for this application is the Assignee, JTEKT CORPORATION. An assignment against this application has been filed with the U.S. Patent Office and is recorded at Reel/Frame: 018111 / 0683.

II. RELATED APPEALS AND INTERFERENCES

There are no other related appeals, interferences, or judicial proceedings related to the present application known by the Appellant or Appellant's Legal Representatives that will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

A. Total Number of Claims in Application

There are 4 claims pending in application.

B. Current Status of Claims

1. Claims canceled: 1-4
2. Claims withdrawn from consideration but not canceled: None
3. Claims pending: 5-9
4. Claims allowed: None
5. Claims rejected: 5-9

C. Claims on Appeal

The claims on appeal are claims 5-9.

IV. STATUS OF AMENDMENTS

No amendments have been presented after the Non-Final Rejection dated February 4, 2010.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The invention of claim 5 is directed to a rack-and-pinion steering apparatus including pinion teeth (4) provided on a circumferential surface of a pinion shaft (2) and rack teeth (3) provided on an outer surface of a rack shaft (1), meshed with each other substantially without backlash, so as to transmit rotation of the pinion shaft (2) connected to a steering member (22) to the rack shaft (1) via a mesh portion between the pinion teeth (4) and the rack teeth (3), thus to move the rack shaft (1) in an axial direction thereof at a predetermined stroke ratio for execution of steering operation. See Figs. 1-3, page 10, line 12 to page 11, line 15, and page 13, line 24 to page 14, line 6. The pinion teeth (4) are provided with a module m, a number of teeth z, a tooth depth h and a helix angle β that remain within the following respective ranges, while satisfying a pressure angle α being within a range of 24° to 30° and the stroke ratio: module m: 1.8 to 2.0, number of teeth z: 7 to 13, tooth depth h: 2m to 2.5m, and helix angle β: 40° or smaller. See Figs. 2-4 and page 24, lines 11-20. In addition, a trochoid interference clearance (t) of the rack teeth (3) and pinion teeth (4) is positive. See Fig. 5(b) and page 19, line 23 to page 20, line 12.

The summary to the claimed invention herein is being made to comply with the Patent Office rules in submitting Briefs and is not to be considered as limiting the claimed invention.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The Final Office Action provides two (2) grounds of rejection for review on appeal.

1) Claims 5-7 and 9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,382,389 to Namiki et al. ("Namiki") in view of U.S. Patent No. 6,080,199 to Umeyama et al. ("Umeyama"), and in further view of U.S. Patent No. 6,023,989 to Imase et al. ("Imase").

2) Claim 8 stands rejected under 35 U.S.C. § 103(a) as being unpatentable Namiki in view of Umeyama and Imase, and in further view of U.S. Patent No. 6,834,742 to Nakatsu et al. ("Nakatsu").

VII. ARGUMENTS

Claims 5-7 and 9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Namiki in view of Umeyama, and in further view of Imase. This rejection is respectfully traversed.

Because the rejection is based on 35 U.S.C. § 103, what is in issue in such a rejection is "the invention as a whole," not just a few features of the claimed invention. Under 35 U.S.C. § 103, "[a] patent may not be obtained . . . if the differences between the subject matter sought to be patented and the prior art are such that the subject matter *as a whole* would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." The determination under Section 103 is whether the claimed invention *as a whole* would have been obvious to a person of ordinary skill in the art at the time the invention was made. *See In re O'Farrell*, 853 F.2d 894, 902, 7 USPQ2d 1673, 1680 (Fed. Cir. 1988). In determining obviousness, the invention must be considered as a whole and the claims must be considered in their entirety. *See Medtronic, Inc. v. Cardiac Pacemakers. Inc.*, 721 F.2d 1563, 1567, 220 USPQ 97, 101 (Fed. Cir. 1983).

In rejecting claims under 35 U.S.C. § 103, it is incumbent on the Examiner to establish a factual basis to support the legal conclusion of obviousness. *See In re Fine*, 837 F.2d 1071, 1073, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In so doing, the Examiner is expected to make the factual determinations set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), and to provide a reason why one of ordinary skill in the pertinent art would have been led to modify the prior art or to combine prior art references to arrive at the claimed invention. These showings by the Examiner are an essential part of complying with the burden of presenting a *prima facie* case of obviousness. *See In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992).

Appellant respectfully submits that the Examiner has failed to establish a *prima facie* case of obviousness in rejecting independent claim 5.

Independent claim 5 is directed to a rack-and-pinion steering apparatus including pinion teeth provided on a circumferential surface of a pinion shaft and rack teeth provided on an outer surface of a rack shaft, meshed with each other substantially without backlash, so as to transmit rotation of the pinion shaft connected to a steering member to the rack shaft via a mesh portion between the pinion teeth and the rack teeth, thus to move the rack shaft in an axial direction thereof at a predetermined stroke ratio for execution of steering operation. The pinion teeth are provided with a module m, a number of teeth z, a tooth depth h and a helix angle β that remain within the following respective ranges, while satisfying a pressure angle α being within a range of 24° to 30° and the stroke ratio: module m: 1.8 to 2.0, number of teeth z: 7 to 13, tooth depth h: 2m to 2.5m, and helix angle β: 40° or smaller, and wherein a trochoid interference clearance of the rack teeth and pinion teeth is positive.

Appellant respectfully submit that this combination of elements as set forth in independent claim 5 is not disclosed or made obvious by the prior art of record, including Namiki, Umeyama, and Imase.

Considering Namiki as a whole, Namiki is directed to defining a point of contact between the rack teeth and the pinion teeth according to the disclosed formulas (4) and (5) so as to prevent inclination and rocking a rack by well-balanced moments. Also, in Namiki, the disclosed pressure angle and the helix angle are taken into consideration in view of the configuration parameters and of operation aspects. Finally, Namiki discloses that when a rack-and-pinion has a transverse contact ratio $\varepsilon_s \leq 1$, the rack is kept free of rocking and inclination, and thus free from biting. See col. 5, ll. 29-32.

Considering Umeyama as a whole, Umeyama is directed to designing the tooth specifications based on an actual contact ratio. *See* col. 1, l. 66 to col. 2, l. 3. The purpose of focusing on actual contact ratio, Umeyama discloses that increasing actual contact ratio reduces transmission error amplitudes, resulting in reduced gear noise. Accordingly, all the exemplary gears detailed in Tables 1 and 2 disclose a transverse contact ratio of 1.60 or greater.

With this understanding of the teachings of Namiki and Umeyama, Appellant submits that one of ordinary skill in the art would not have combined the references as set forth by the Examiner. As such, Appellant submits that the Examiner has failed to establish a *prima facie* case of obviousness as will be described below.

At the outset, Appellant notes that the Examiner alleges that Namiki discloses a pinion gear having between 7 and 13 pinion teeth. Appellants respectfully disagree. As clearly seen from Fig. 7, there are five pinion teeth 67. Furthermore, Appellants note that all of the examples in Umeyama disclose gears having 98 teeth, 53 teeth, 43 teeth, or 29 teeth. See for example Table 1 at col. 11. Imase was not cited for the teaching of the number of pinion teeth. As such, none of the cited references directed to gears with teeth disclose a pinion gear having between 7 and 13 teeth. Consequently, any hypothetical combination of Namiki, Umeyama, and Imase would necessarily fail to teach or suggest the claimed rack-and-pinion steering apparatus as set forth in independent claim 5 for at least this reason alone.

The Examiner alleges that in regards to the limitation "wherein the pinion teeth are provided with a module m, a number of teeth z, a tooth depth h and a helix angle β that remain within the following respective ranges, while satisfying a pressure angle α being within a range of 24° to 30° and the stroke ratio: module m: 1.8 to 2.0, number of teeth z: 7 to 13, tooth depth h: 2m to 2.5m, and helix angle β: 40° or smaller," Namiki discloses the claimed invention except

for identical ranges for the above values. The Examiner, citing *In re Aller*, further states that it would be obvious to one of ordinary skill in the art to select these ranges because "it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art." Appellant respectfully submits that under this interpretation, no improvement of a toothed gear will be patentable because all toothed gears will have a module, a number of teeth, a tooth depth, and a helix angle and therefore, under the Examiner's interpretation of *In re Aller*, any variations thereof would be obvious. Clearly, this is not what is intended by *In re Aller*.

Rather, in addition to *In re Aller*, the M.P.E.P. further stresses that "[a] particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation." M.P.E.P. § 2144.05(II)(B) (citation omitted). In determining whether or not such experimentation is within the teachings of the art, one "must be ever alert not to read obviousness into an invention on the basis of the applicants' own statements; that is, we must view the prior art without reading into that art appellants' teachings." *In re Sponnoble*, 160 USPQ 237, 243 (CCPA 1969).

There is nothing in Namiki to suggest that the number of teeth, tooth depth, and module are result effective variables. And while Umeyama disclose various gears having various number of teeth, various tooth depths, and various Normal modules, the number of teeth are significantly greater than the claimed number of teeth, as noted above, and the end result of the various parameters are gears having a significantly higher transverse contact ratio than those of Namiki.

In particular, Namiki discloses that when a rack-and-pinion has a transverse contact ratio $\varepsilon_s \leq 1$, the rack is kept free of rocking and inclination, and thus free from biting. See col. 5, ll.

29-32. In contrast to Namiki, the tooth specifications of Umeyama result in backlash. See for example the exemplary gears detailed in Tables 1 and 2, all of which disclose a transverse contact ratio of 1.60 or greater. Consequently, one of ordinary skill in the art would not look to Umeyama to modify Namiki to provide the claimed rack-and-pinion gear because Namiki specifically discloses a transverse contact ratio $\varepsilon_s \leq 1$ whereas the teaching of Umeyama are to provide a transverse contact ratio greater than 1 (e.g., 1.60 or more).

Finally, with regards to Umeyama, in the last Office Action, the Examiner directed Appellant's attention to col. 10, ll. 9-10, col. 24, ll. 45-49, and col. 27, ll. 61-64 to support Umeyama disclosing a method of designing a gear wherein the gear has a module m of 1.8 to 2.0 and a tooth depth of 2m-2.5m.

Regarding the disclosure of Umeyama at col. 10, ll. 9-10, while it is true that Umeyama discloses a normal module of 2 and a tooth depth of 4.9 mm, the context of this gear design is for a gear with a significantly greater number of teeth (e.g., 40 teeth) and a smaller pressure angle (e.g., 20°) compared to both the claimed invention and Namiki. And as noted above, the focus of Umeyama is to provide gear teeth having a transverse contact ratio greater than 1.

Regarding the disclosure of Umeyama at col. 24, ll. 45-49, Appellant notes that this passage is directed to tooth width and not tooth depth.

Regarding the disclosure of Umeyama at col. 27, ll. 61-64, Appellants note that this passage describes providing a gear with a tooth depth of at least 2.5 times the normal module and a helix angle of at least 20° to reducing the transmission error amplitude. By reducing transmission error amplitudes, Umeyama seeks to reduce gear noise. See col. 1, ll. 62-65. As noted in Umeyama, increasing the effective contact ratio decreases the transmission error (gear noise). See col. 2, ll. 25-31.

In summary, Umeyama is focusing on a gear design that effectively provides a higher contact ratio to reduce transmission errors for a gear with a significantly higher number of teeth and at a pressure angle lower than the pinion gear set forth in the claimed invention and described by Namiki. Accordingly, one of ordinary skill in the art would not look to Umeyama for teachings to modify the rack-and-pinion steering apparatus of Namiki.

Therefore, for at least these reasons, one of ordinary skill in the art would not have derived the claimed invention based on the hypothetical combination of Namiki, Umeyama, and Imase.

Finally, as conceded by the Examiner, Namiki fails to disclose a trochoid interference clearance of the rack teeth and pinion teeth being positive. The Examiner turns to Imase to allegedly teach the combination. The Examiner has directed Appellant's attention to Figs. 1, 6, and 7, which describe rollers 6 and rack teeth 4.

Appellant respectfully submit that Imase is directed to a rack and pinion structure where either the pinion or the rack is composed of a plurality of rollers. The purpose of using a roller is to obviate the inconvenience caused by a structure in which a tooth meshes with another tooth. Compare col. 1, ll. 31-35 to Figs. 18, 19, and col. 1, ll. 18-30. In other words, Imase, as a whole, is directed at a rack and a pinion that overcomes the problems of meshing teeth (e.g., the teeth of Namiki and Umeyama) by replacing one set of teeth with rollers. As such, if anything, Imase would suggest to one of ordinary skill in the art the desirability of replacing the teeth of either the rack or pinion with rollers. Moreover, it cannot be said that Imase teaches or suggest providing a trochoid interference clearance of rack teeth and pinion teeth being positive. Therefore, one of ordinary skill in the art would not look to Imase to teach modifying a hypothetical combination of Namiki and Umeyama further to provide a positive trochoid interference clearance of the rack teeth and pinion teeth.

The Examiner has not provided any rationale to explain why one of ordinary skill in the art would take away only a teaching of a trochoid interference clearance being positive from Imase without the underlying teaching of replacing the teeth of either the rack or the teeth of the pinion with rollers.

For at least this additional reason, Appellant respectfully submits that the rejection of independent claim 5 over Namiki, Umeyama, and Imase is improper.

Reconsideration and reversal of the rejection of independent claim 5 is respectfully requested. Claims 6, 7, and 9 stand or fall with independent claim 5.

Claim 8 stands rejected under 35 U.S.C. § 103(a) as being unpatentable Namiki in view of Umeyama and Imase, and in further view of Nakatsu.

Appellant submits that claim 8 depends from independent claim 5 and is allowable for at least the same reason that independent claim 5 is allowable. Specifically, Nakatsu was not cited for teachings related to overcoming the deficiencies note above with regards to the combination of Namiki, Umeyama, and Imase.

Moreover, Nakatsu discloses a variable gear ratio mechanism instead of an electric power steering apparatus (EPS). To the contrary, according to claim 8, obtained is the strength of the teeth so as to endure the steering torque of a driver and the assist torque of the motor applied to the pinion shaft in the EPS.

Accordingly, the Office Action fails to make out a *prima facie* case of obviousness of the claimed invention.

Reconsideration and reversal of this rejection of dependent claim 8 is respectfully requested.

VIII. CLAIMS

A copy of the claims involved in the present appeal is attached hereto as Appendix A.

IX. EVIDENCE

There is no additional evidence pursuant to §§ 1.130, 1.131, or 1.132 and/or evidence entered by or relied upon by the examiner that is relevant to this appeal as noted in Appendix B.

X. RELATED PROCEEDINGS

No related proceedings are referenced in II. above, and thus, copies of decisions in related proceedings are not provided.

XI. CONCLUSION

For the reasons set forth above, Appellant respectfully submits that all claims in this application are allowable. Thus, favorable reconsideration and reversal of the Examiner's rejections and the allowance of claims 5-9 by the Honorable Board of Patent Appeals and Interferences are respectfully solicited.

If necessary, the Director is hereby authorized in this, concurrent, and future replies to charge any fees required during the pendency of the above-identified application or credit any overpayment to Deposit Account No. 02-2448.

Dated: August 24, 2010

Respectfully submitted,

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Attachments: Appendix A
Appendix B
Appendix C

APPENDIX A

Claims Involved in the Appeal of Application No. 10/585,759:

1-4. (Canceled)

5. (Previously Presented) A rack-and-pinion steering apparatus including pinion teeth provided on a circumferential surface of a pinion shaft and rack teeth provided on an outer surface of a rack shaft, meshed with each other substantially without backlash, so as to transmit rotation of the pinion shaft connected to a steering member to the rack shaft via a mesh portion between the pinion teeth and the rack teeth, thus to move the rack shaft in an axial direction thereof at a predetermined stroke ratio for execution of steering operation,

wherein the pinion teeth are provided with a module m, a number of teeth z, a tooth depth h and a helix angle β that remain within the following respective ranges, while satisfying a pressure angle α being within a range of 24° to 30° and the stroke ratio:

module m: 1.8 to 2.0,

number of teeth z: 7 to 13,

tooth depth h: 2m to 2.5m, and

helix angle β: 40° or smaller, and

wherein a trochoid interference clearance of the rack teeth and pinion teeth is positive.

6. (Previously Presented) The rack-and-pinion steering apparatus according to claim 5, wherein the pinion teeth are subjected to a tooth surface modification such that a difference in pressure angle is provided in a direction of the tooth profile so as to increase a mesh stress with the rack teeth, and that a central portion thereof is formed in a convex shape.

7. (Previously Presented) The rack-and-pinion steering apparatus according to claim 5, wherein the pinion teeth are subjected to a tooth surface modification of crowning along a tooth trace direction.

8. (Previously Presented) The rack-and-pinion steering apparatus according to claim 5, wherein a motor for steering assistance is disposed between the steering member and the pinion shaft, thus to constitute an electric power steering apparatus that transmits the rotational force of the motor to the pinion shaft to assist the steering operation executed according to the rotation of the pinion shaft.

9. (Previously Presented) The rack-and-pinion steering apparatus according to claim 5, wherein the trochoid interference clearance is 0.3 mm or more.

APPENDIX B

None.

APPENDIX C

None.